BRÜCKNER MASCHINENBAU

A Member of Brückner Group

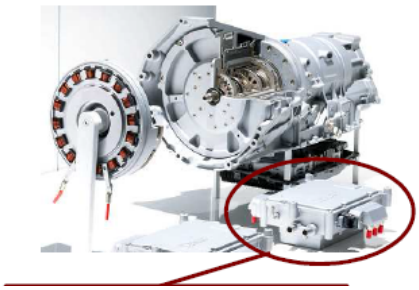
HoTeKo: New materials for high temperature film capacitors

Project duration: 1.04.2014 bis 31.3.2017

Project initiators: VDI/VDE IT for the Federal Ministry of Education and Research BMBF

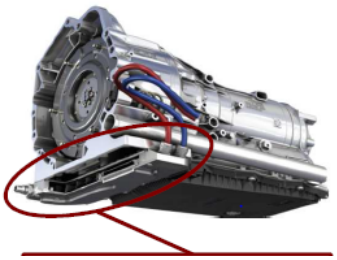
The legal standards for energy efficiency drives („Motorenverordnung“ 640/2009) causes the need for novel, efficient power electronic converters, which need to be developed in the power range of 0.75kW.

State of the art



Power electronic: external
Heat exchange water: 65°C
Power density: 10kW/l
Voltage: 400 V

Project HoTeKo



Power electronic: intern
Heat exchange water: 105°C
Power density: 18kW/l
Voltage: 400 V

Quelle: ZF Friedrichshafen AG

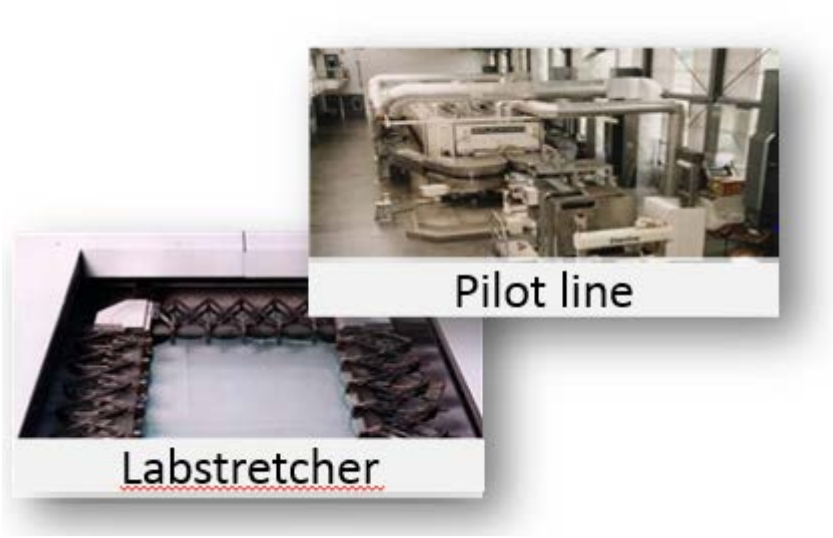
The capacitors are a key component of power electronics, especially in the field of decentralized drives requirements exist regarding higher temperature stability and component size that cannot be realized with existing capacitors. Up to now, BOPP or BOPET based capacitor films with restrictions in temperature stability or in dielectric strength are used.

The project aims are to develop new innovative polymer-based films or coextruded polymers, which have a high voltage and temperature resistance. The materials have to be biaxially oriented to a film thickness of 3 µm and the materials must be metallized. This enables the production of film capacitors with high capacitance density (<2F/l) and with high voltage and temperature stability.

As goal of the project, it should be possible to double the previous peak of power density of an inverter.

During the project, 20 dielectric materials have been tested for stretching and functionability, metallization, dielectric properties and mechanical strength for further processing. Not only the material properties, also the costs limit suitable materials.

The next step is to transfer the results of suitable materials from the discontinuous process to the continuous pilot line process to get sample rolls for the metallization process.



After that, the capacitor life tests will finally define the new dielectric films in capacitors.

	Material 1		Material 2	Material 3	Material 4		Material 5	Material 6	Material 7	
	Variant 2	Variant 1			Semi crystalline	amorph			Homopolymer	Copolymer
strechability	☹	😐	😐	☹	☹	☺	☺	☺	☺	☺
shrinkage	k. a	😐	😐	k. a	k. a	☺	☺	☺	☺	☺
Mechanical properties	k. a	😐	☺	k. a	k. a	☺	😐	😐	☺	☺
BDV	k. a	☺	☺	k. a	k. a	☺	☺	☺	☺	
εr (50Hz/1kHz)	k. a	☺	☺	k. a	k. a	☺	😐	☺	☺	
tan δ (50Hz/1kHz)	k. a.	☺	☺	k. a.	k. a.	☺	☺	☺	☺	😐
Handling	☹	😐	😐	😐	k. a.	☺	☺	☺	☺	☺
Costs in comparison to PPC [0,035$/m²]	+630%		+800%	+171%	+1400%		+100%		+34%	

The project consortium consists of the companies Brückner Maschinenbau GmbH & Co.KG, KEMET Electronics GmbH, Lenze SE, ZF Friedrichshafen AG and Fraunhofer-Institut für Verfahrenstechnik und Verpackung IV.

The consortium is grateful to the BMBF and the VDI/VDE for their kind support of the project.

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